

THE HUMAN DIMENSION IN INTELLIGENT LIVING ENVIRONMENT

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ABSTRACT

Due to the rapid aging of the Dutch population and aging-in-place policies, an increasing demand for suitable dwellings focused on the human dimension of construction is to be expected. This global issue of aging in place is a wakeup call for us architects to move towards constructions that empower this active aging. A significant contribution can be provided by “Domotics”; which is defined as the advanced technological equipments and services in the domestic environment to sustain and to enhance the quality of aging in place as well as empowerment of the senior citizen (in daily life). This paper is based on literature review, qualitative and quantitative studies i) it seeks to inform the development of domotics technology in the living environment of the older adults; ii) it provides an overview of the multiplicity of needs and attitudes of the older citizens in regards to smart technology in the domestic environment; iii) and develops recommendations to incorporate domotics in the architectural structure of the dwelling keeping the Human factor in mind. This study on senior citizens’ needs and attitudes toward domotics is based upon a triangulation of cohort-group discussions, enabling techniques and in-depth interviews followed by a postal questionnaire survey. The findings indicate that needs, perceptions, environmental and personal attributes of the seniors determine their attitudes towards automation. This attitude can be described as ‘critical/positive’. Too much automation, where little or no consideration is put towards the user’s needs, is regarded as undesirable. Ethical considerations are particularly related to, professional stakeholders, especially caregivers, whereas seniors are mainly interested in the functionality of domotics. The integration and domestication of domotics in a house needs to be a synthesis of the user’s needs, technology, the living environment, services and healthcare. To enable aging in place and the acceptance of (care through) domotics we need, i) to familiarize inhabitants with smart technology, ii) to domesticate and personalize it, iii) as well as to (imperceptibly) apply need-based technology in the (pre-existing) homes.

Keywords: *aging in place, domotics, residential needs, human dimension*

ABSTRAK

Karena jumlah penduduk Belanda yang meningkat dengan cepat dan kebijakan yang berkembang, maka diharapkan meningkat pula permintaan untuk tempat tinggal yang cocok difokuskan pada dimensi dari konstruksi manusia. Isu global peningkatan di tempat adalah panggilan bangun bagi kita arsitek untuk bergerak ke arah konstruksi yang memberdayakan ini penuaan aktif. Sebuah kontribusi yang signifikan dapat diberikan oleh "Domotics"; yang didefinisikan sebagai peralatan teknologi canggih dan jasa di lingkungan domestik untuk mempertahankan dan meningkatkan kualitas penuaan di tempat serta pemberdayaan warga senior (dalam kehidupan sehari-hari). Tulisan ini berdasarkan tinjauan literatur, studi kualitatif dan kuantitatif i) berusaha untuk menginformasikan perkembangan teknologi domotics dalam lingkungan hidup orang dewasa yang lebih tua; ii) memberikan gambaran tentang banyaknya kebutuhan dan sikap warga yang lebih tua dalam teknologi di lingkungan sendiri; iii) dan mengembangkan rekomendasi untuk memasukkan domotics dalam emikiran manusia dalam menjaga faktor struktur pada arsitektur hunian. Studi tentang kebutuhan warga senior dan sikap terhadap domotics didasarkan atas triangulasi kelompok-kelompok diskusi, memungkinkan teknik dan wawancara yang mendalam yang diikuti dengan survei kuesioner. Temuan menunjukkan bahwa kebutuhan, persepsi, atribut lingkungan dan pribadi dari para senior menentukan sikapnya terhadap otomatisasi. Sikap ini dapat digambarkan sebagai sikap 'kritis / positif'. Terlalu banyak otomatisasi, di mana sedikit pertimbangan atau tidak diletakkan pada kebutuhan pengguna, dianggap tidak diinginkan. Pertimbangan etis khususnya yang berkaitan dengan, stakeholder profesional, terutama pengasuh, sedangkan senior terutama tertarik pada fungsi domotics. Integrasi dan domestikasi domotics di sebuah rumah perlu menjadi sintesis dari kebutuhan pengguna, teknologi, lingkungan hidup, layanan dan healthcare. Hal ini memungkinkan kematangan dan penerimaan (perawatan melalui) domotics yang dibutuhkan, i) untuk membiasakan penduduk dengan teknologi cerdas, ii) untuk menjinakkan dan mempersonalisasikan, iii) serta (tersamar) perlu berbasis teknologi dalam (sudah ada) pada rumah.

Kata kunci: *kematangan, domotics, kebutuhan perumahan, dimensi manusia*

INTRODUCTION

The three societal revolutions of the 21-century; demographic change, the exponential Information and Communication Technologies (ICT) development and our post-industrial society, have all affected the architectural design and building sciences.

The world population is experiencing an increase in the absolute and relative numbers of people in their 55's in both developed and developing countries. This "population ageing" phenomenon is a result of both mortality and fertility: fewer children are born and more people reached old age.

Over the last fifty years, the mortality rates in developing countries have declined dramatically, resulting in a rise in the average life expectancy at birth from around 41 years in the early 1950s to 62 years in 1990 and is expected to reach 70 years in 2020. Birth rates have incurred sharp falls in nearly all developing countries except for most of the sub-Saharan African Region. In the coming 25 years, Europe is projected to retain its title of the “oldest region in the world”.

Currently older people represent around 20% of the total population and will represent 25% by 2020; where it will contribute to the total population by 23% in North America, 17% in East Asia, 12% in Latin America and 10% in South Asia (Kalasa, 2001).

By 2020 more than 1000 million people aged 60 years and older will be living in the World, more than 700 million of them in Developing countries. In most European Union (EU) Countries the issue of (double) aging of the population is rising (Figure 1). Policies regarding the older citizens and consequently the health care system are liable to large changes. As a shortage of formal care threatens, an increasing appeal is made for self-management and informal care.

The rate of the demographic ageing process in the Netherlands will double in the years to come. This acceleration is due to the baby boom generation born after the Second World War who are now reaching the age of 55 and over (Figure 1). Due to this increase in the older population, an increase in the demand for adaptable houses can be expected.

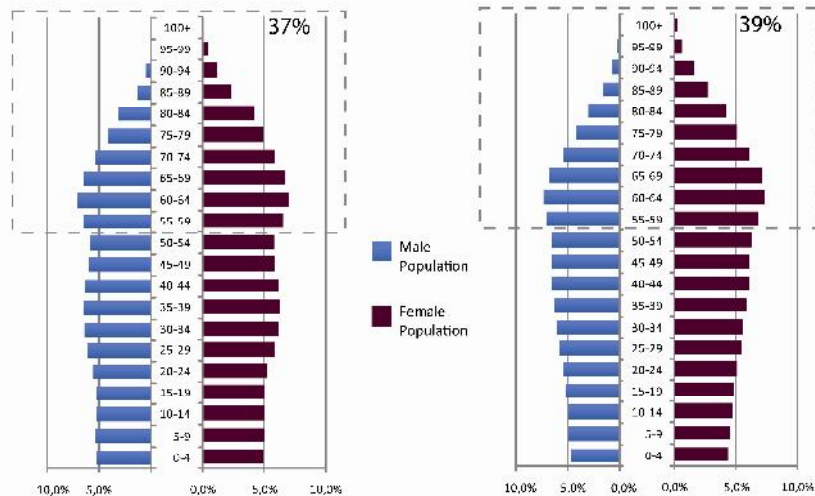


Figure 1. Population Profile in 2030: Forecasts for Western Europe and the Netherlands
 Source: United States Census Bureau International Database, 2010

Active Aging

Aging well and improving the quality of life for older citizens is becoming a progressively essential mission for most (European) countries. One of the most challenging paradigms regarding the Quality of Life is “active aging” or “the process of optimizing opportunities for health, participation, and security in order to enhance the quality of life as people age” (WHO, 2002). The EU is undertaking aging related problems as part of the general strategy of the mutually reinforcing policies launched at the Lisbon European Council (2000).

From an economical perspective, it seems that senior individuals who remain living in their homes save society up to €16,000 per person per year (SCP, 2004). In 2030, 37% of the Dutch population will be 55 years or older (roughly six million people), so we talk about saving approximately a hundred billion Euros per year.

Aging in place is a philosophy as much as a concept that promotes independency and habitability of all types of houses (Lawlor and Thomas, 2008), which refers to the ability to remain in one’s home or neighbourhood buildings for as long as possible (Nasar and Evans-Cowley 2007) regardless of the age of the occupant or his/her level of abilities. It is a complex topic since it is imbedded in the broader context of the social, physical, and organizational environment.

As a population progresses towards elderliness, the need for higher quality and at the same time better efficiency in health care at home become more imperative. This means that in order to optimize a senior’s home; healthcare, and the suitability and accessibility of care and services in the near surroundings must be persistent. This philosophy supports not only such fundamental attachments of the older adult but also the level of wellbeing, convenience, security, and care. Aspects such as universal and barrier free design, adaptability, visitability, and accessibility are also incorporated into the aging in place philosophy.

In the coming decades the development of new living and care concepts and new types of housing for older people will come to stand as a main point in most countries agenda (ECTP, 2005). The Construction sector and Architectural design can help in improving the senior’s level of living independently by developing new types of dwellings. These all ask for a shift towards an inhabitant-centred approach that will occur, in part, by a transfer from the supply-led market to a demand-orientated market.

People construct their social identity through their consumption and use of products (Belk, 1988; Dittmar, H. 1989; Kleine and Kernan, 1993). As the home is the single largest purchase most people ever make, it is often the largest product through which people enact their social identity. Personalizing their homes deepens their investment, and displaying them allows for a sense of fulfilment (Belk, 1988). After a lifetime of personalizing and adapting their homes to themselves, it is quite under-

standable that anyone would prefer to remain as long as possible in their homes, which in a way has become an extension of themselves.

Aging in Place a Wake-up Call

This part of the paper unpacks the main considerations and questions that are significant to understand the Dutch seniors' needs and expectations in regards to intelligent homes; it is based on the author's PhD research and experiences of designing suitable homes for older Dutch adults.

The issue of Aging in place and the use of technology in regards to this issue is a wake-up call for all design professionals (Lawlor and Thomas, 2008) and especially for architects. Moreover, it emphasizes a major opportunity for those who appeal to the needs and wellbeing of residents and who understand how to integrate these needs into today's designs, that benefit the dweller of the future. Aging in place is a very multifaceted issue and in broad terms, does not only entail a suitable house but also mobility, an accessible environment that since 25 % of the Dutch elderly population make use of a walking aid (CBS, 2011), availability of (in)formal care, where informal care consists out of family and friends that support and help the person, and services, social contact and activities

Extra-muralisation has resulted in longer independent living older people, who are receiving the necessary care at home. However, the questions remain. What do the seniors want to do in their homes? What kinds of needs do they have? These questions have affected our way of thinking about 'living and residing' giving rise to other questions of what "home" in the present context entails.

Due to the fact that home has increasingly been developing into "a place to live" rather than just "a place to stay" (Mason et al., 1983) new living and care concepts should be offered from the construction sector and be steered towards the use of technology in improving the quality of life. Because of the increasing aging population and an ever-decreasing work force there will be an extreme shortage in the healthcare sector.

Domotics to Meet Residential Needs

One of the opportunities presented by innovation in science and technology is *domotics* which is defined as the smart technological equipments and services in the domestic environment to sustain and to enhance the quality of aging in place as well as empowerment of the senior citizen (in daily life).

In order to develop a domotica house, where the seniors are independent for as long as possible, it is essential to gain insight into the needs of the people residing in them. Domotics can be an adequate medium to enhance the quality of housing and empower the senior for a self-reliable life, as long as there is a balance between the daily activities of the seniors and the share of technology in it. Thanks to these

technological opportunities, the care can be offered at home, where fewer caregivers will be involved whilst the care in the institutions will become more intense. Intelligent technology i.e. domotica can play a very important, necessary as well as facilitating role both in the personal home as well as in the care institutions. However, seniors desire to decide, independently, whether they will apply the current technology; this can conflict with the rigidity of current domotic applications. Technology must respond to the needs and feelings the seniors' have about advanced technological appliances at that particular time and place. Making the houses suitable for aging in place and improving, the quality of housing, by for instance optimal adjustments and implementation of domotics, has a direct influence on the wellbeing and quality of life of the seniors.

Satisfying residential needs and providing "total enjoyment of the property" is seen as an interaction of the following five dimensions (Priemus, 1984; Hayward, 1975): (i) shelter dimension; (ii) utilitarian dimension, (iii) a territorial dimension, (v) symbolic dimension, and (iv) communication dimension. Because of this, our houses are becoming multi-functional: it is not only a place where you reside, but also a place where you can work and relax, and it can also function as a place where for a portion of your life, you receive care.

In order to fulfil the aspects of total enjoyment of the home and aging-in-place, the house and environment will need to be adapted and furnished to enable and facilitate help as well as services. This is not an easy task. Since this not only entails incorporating new designs and products for senior living but also adaptation of the already existing structures to the needs of what they need. The volume of new buildings being constructed is inadequate to check this problem of aging or to sustain the need for smart assisted homes.

This is an area where domotics technology can play a very crucial role and become a necessity in bridging the gap between the needs and the availability of care, in their homes as well as in the care institutions. Through means of domotics, homecare can become more efficient and sustainable; resulting in the enablement of the older people to remain autonomous and independent for longer periods, while supporting their self-management issues. This is essential for the contemporary seniors. Hence, the ability of creating buildings that enable independent living through means of adaptation and application of domotics, in order to improve the quality of housing and thus directly influence the wellbeing and quality of life of the older people is becoming essential.

At this moment, we can safely state that there is no optimal match between technology and the care practices (Mohammadi 2010). There is insufficient insight into the effect of automation; not only in the quality and quantity of care but also in the 'Humane Aspect'. Study into how the application of domotics is experienced by the care receiver (in this case the seniors) is also lacking, as well as the manner that the caregivers think about this.

However, to realise its full potential we still need to solve certain issues and win over the resistance that is present in both the care as well as construction sectors.

To realise active aging-in-place the disciplines of care, architecture, construction, as well as (smart) technologies are expected to take an active and innovative role in this societal process. The care and construction sectors are gradually trying to bring more diversity and variety into the construction methods and adapt new technologies (Stephanidis, 2001; Mace et al., 1991; Lichtenberg, 2005).

This entails the designing and building of inhabitant-centred domotic homes with the delivering of (care) services on needs basis. In order to do this the house needs to be smart enough to meet the needs of its inhabitant. The success or failure of technological innovations and the quality of the product are also determined by whether or not the needs and requirements of the user are understood effectively (Zeisel, 1997; Keiser and Smith, 1994; Nasar and Evans-Cowley, 2007). Therefore research has been done into the residential needs and attitude of the Dutch seniors towards domotics in the living environment.

Theoretical Background

Since General Electric introduced the “consumer oriented marketing concept” in 1950 (Berry, 1988), the requirement for investigating the attitudes and needs of the end user has risen. Prior to examining the added value of technological innovations, it must be made clear which needs the user has, which in its turn, the value of the applications represent to him, and what the attitude of the user towards such a technology is. Answering to one or more needs is the starting point of each innovation as well as domotics should address needs such as: the need for security, social needs, and self esteem needs (Maslow, 1954).

Regarding the introduction and acceptance of smart technologies in the dwelling three mainstreams can be distinguished (Pedersen and Ling, 2002):

- Diffusion theory (Rogers, 2003) focuses on a macro- and organisational level and illustrates the distribution speed of a product over the population over a period of time.
- The Domestication Theory (Silverstones and Kirsch, 1992) especially aims at the adaptation of new technology in daily life; the emphasis lies on the social consequences of domestication of new technologies and the process through which the technology is integrated into the life of the user. This theory states that meanings of technologies are not in the technology itself, but are formed by the interactions between all actors such as: users, designers, and policy makers. Therefore, it can be concluded that the design and development of a domotic home and the utilization of the domotic home are not separate processes.
- The Adoption theory focuses on individual decision-making processes in which different theories such as Theory of Reasoned Action (Fischbein and Ajzen, 1975) and the Technology Acceptance Model (Davis, 1989) are used.

Although these studies generally have the same goal, determining which factors affect the dweller in deciding whether or not to use the innovation, different techniques have been used to achieve this.

Conceptual Framework

Although several studies have been done on the application of technology in the household domain (Venkatesh, et al. 2003; Silverstones and Kirsch, 1992), not enough information is available about meeting the needs and preferences of potential users for domotics (ECTP, 2005). It is also difficult for experts to obtain scientifically based, reliable information on the subject (Thackara, 2003; Batenburg et al., 2004).

The aim of the paper is to outline the needs and attitude of the seniors towards the (non) implementation of domotics in residential homes and to set the terms for the development in the provision of domestication of these smart applications and services at home.

Through this research, the supply side gets to know the target groups and their expectations better, and can thus channel and adjust their innovative housing concepts and services to the target group.

The theoretical framework of this study is built on a combination of the Theory of Reasoned Action (Fishbein and Ajzen, 1975), the Technology Acceptance Model (Davis, 1989) and Domestication theory (Silverstone, 1992). User demand has been taken for granted in this research, and further analyses of these demands are examined to unearth the actual need(s) these demands are based upon. Therefore, the relation between the inhabitant’s needs, preferences, and underlying motives are investigated by the user needs analysis and research into their attitude.

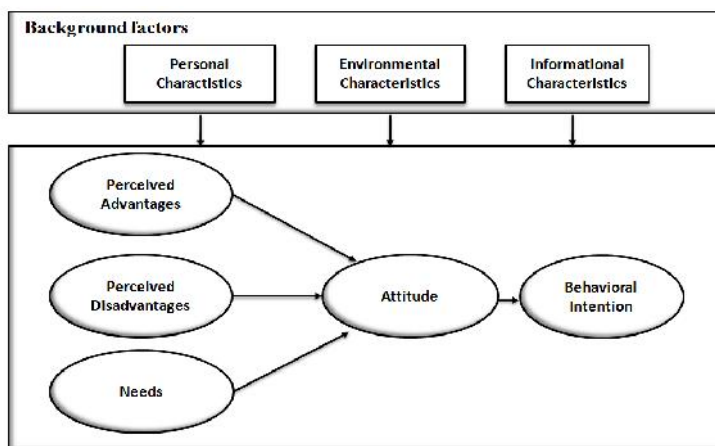


Figure 2. Conceptual Framework Attitude Towards Domotics
 Source: Mohammadi, 2010

The Theory of Reasoned Action and the TAM form the basic principles for the study into attitudes of the senior towards domotic homes (Figure 2). It is geared at the potential inhabitants of intelligent houses. The attitude towards domotica determines whether a person is willing ('readiness for response') (Allport, 1935) to accept the applications. If so, the adoption process begins. Attitudes are determined by cognitive, affective, and social factors. There-fore, during the introduction of domotica it is very important to give ample attention to prejudices and resistance, both from residents as well as caregivers. The adaptation process is facilitated by information, demonstration, discussions, and last but not the least highlighting the opportunities for flexible adaptation for individual needs of the resident. Due to the fact that domotic homes are not yet available on the housing market and the majority of the target group does not possess the appli-cations, this investigation focuses on the clarification and the approach of the attitude of potential users towards domotics.

Homes as a social construction have a consequence for living and affect the inhabitant's quality of life. Domotics, keeping in line with Silverstone (1992), must first be domesticated within the house before it can become accepted as an achievement. The expectations of inhabitants, especially the older individuals, of a new technology are related to the activities in the daily life and their needs. Environmental psychologists state that inhabitants with different lifestyles have different activity patterns (Rappoport, 1977), while the spatial design attributes such as size and arrangement of rooms in a house is also found to affect the experience of the "total enjoyment" (Pennartz, 1986) of the home. On the other hand, Gibson (1977), from perceptual psychology point of view, suggests that "perception drives action", how dwellers perceive the (possibilities of the) environment influence their action. Consequently domestication of the domotics goes beyond just the purchasing of the applications or services; it is about the progressive integration of it into patterns of daily activities.

Research Methods

Based on these theories and concepts a Conceptual framework (Figure 2) has emerged in this study for the identification of indicators that have influenced the attitude of seniors towards domotics. The study concerns a mix method (Flick, 2007) of qualitative studies and a questionnaire survey.

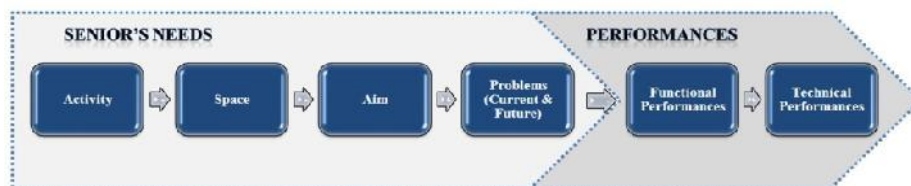


Figure 3. The Process of Conversion of the Needs of the Seniors (Demand) to Domotics (supply)

The qualitative part utilized a focus group, which consisted of nine older individuals between 55 and 75 years of age. In order to conserve the quality of the focus group study several different methodological approaches (cohort-group discussions, enabling techniques and in-depth interviews) have been applied, resulting in a triangulation method. The applied in-depth interview-method (Figure 3) is based on the person-environment fit theory which considers the interrelationships between personal competence and the environment (Lawton, 1982). This method evolved out of research into the housing needs of seniors and concerns the separation between supply and demand (Heijts, 2005) and the possibility of translating the research data into performance requirements. During the interview the focus group is taken on an virtual tour through all the areas and rooms of the house and identifies all the daily activities that take place there. In-depth interviews are conducted on a one-on one basis at the Eindhoven University of Technology (2008).

The chart below (Figure 4) gives an overview of the techniques used in the focus group and the instruments used to carry them out. Six different data collection instruments are used for the three used qualitative techniques:

- The used data collection tools for focus group discussions are: transcriptions and report of the discussions, and the questionnaire “Appreciation Domotics” which is filled in by all the members individually, at the beginning of each session.
- The used data collection tools for in-depth interviews are the Matrix USE and interview transcripts.
- The used data collection tools for enabling techniques are the drawings and notes of the members of the focus group, checklist and questionnaire “How do I want to live”, and the reports of the workshops.

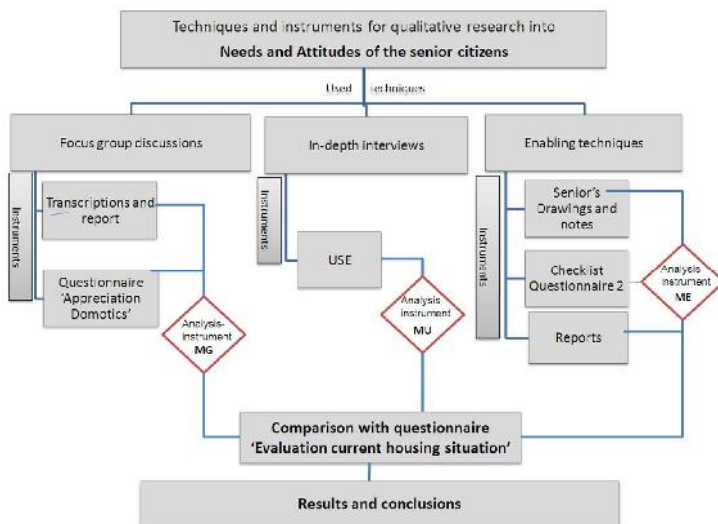


Figure 4. Applied Data Collection Technique to Investigate Needs and Attitudes of Seniors

During two years the necessary data to assess the of focus group's needs and attitudes the relation between the needs, perception, and underlying motives were gathered. Subsequently, a postal questionnaire survey was held, on basis of the results from the in-depth research, into the needs of the focus group among two thousands Dutch older adults. This brought out the functional requirements for domotics. This survey was intended to confirm the findings of the qualitative research and to test the research model. After analyzing the obtained data, the study into needs and attitudes of seniors with respect to the technology in domestic settings is followed by conclusions.

In order to determine the functional performances, the indicated needs of the inhabitants are translated into the technical performances of domotics (Refer to Figure 3). Finally based on the results collected, the characteristics of the desired domotic home was developed.

RESULTS AND DISCUSSION

Needs and Attitude of the Senior Citizens Regarding Domotics

From the empirical research, it seemed that the seniors were generally acquainted with domotic applications and were informed of the benefits and added value of them.

However, they did not have any actual experience with domotics. The user-needs analysis pointed out that seniors do not basically reject domotics after becoming more acquainted with domotics and gaining knowledge of the products, but are "sitting on the fence" and are very critical towards it. However, it appears that seniors are positive about possibly purchasing domotic applications in the future. In this investigation, large individual differences were discovered in the residential seniors' needs; it seems that the seniors' background characteristics (personal, environmental, and informational characteristics) have influence on the determination of their attitude towards domotics. For example, seniors with a lower education more often indicated that they needed domotics, while seniors with a higher education maintained a much more critical approach.

The investigation indicated that the senior was not convinced of the added benefit of the offered functionalities for his or her current life, making the cost-benefit analysis negative. Here no specific domotica function is deemed, by the older people, as the killer application. Hence, the current domotics applications are not attractive enough to achieve the needed breakthrough. The study also led to the conclusion that by weighing up perceived advantages and perceived disadvantages during the decision making process, the benefits, and affinities have more influence on the seniors' attitude than the disadvantages, fears, and resistances. To the senior citizens perception of "advantages", a shift of accent to now and here has taken place. At present,

seniors are not prepared to invest in an application that they, according to themselves, may possibly need in the future. In addition, the “effort” seniors have to make are averagely weighed heavier by age, which could make them more critical, concerning the benefit that is returned. For this reason, it will cost extra energy to convince seniors that domotic appliances have advantages for them in the present rather than just possibly in the future. It also appeared that the needs of seniors have a positive relationship with their attitude and “readiness for response” towards domotics.

Until now, domotics can be characterized as a mismatch between technology and the target group’s needs; through the supply-driven approach, more “variation” has occurred rather than “innovation”. For further development and a breakthrough of domotics, the functions must not only be matched with the actual needs of seniors in a better way, but also the possibilities and added value of domotics must be more clearly demonstrated. This is a great challenge for developers of domotic applications. This does not concern the acceptance of healthcare functions, where usefulness and necessity are recognized by the senior, although its realization is postponed to “later”. It concerns stimulation of interest in functions which are supporting for independently living, by contributing to the sense of safety, well-being, and increase in comfort.

The solutions currently available do not live up to the senior’s needs and requirements. When seniors indicate preferences for domotics applications in the current situation, they choose for applications that improve the comfort (automated lighting (53%), vacation button (38%)) and safety (fire alarm (71%)). Care related applications (such as panic alarm and tele-medicine) currently do not score very high; although with regards to adoption in the future, applications that involve safety and care are chosen more often. This counts for example for the intercom which moves from sixth place to second place and for the panic alarm which is found to be redundant by 73% in the current situation. (Refer to Figure 5)

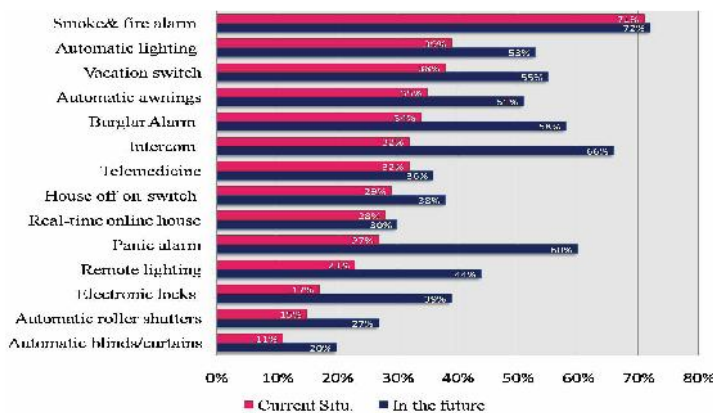


Figure 5. Attitude Towards Intelligent Domestic Applications in the Current Situation vs. in the Case of Moving to Another House

Improvement of residential comfort, in the sense of absence of discomfort, contributes to the extension of independent life. However, current domotic applications are aimed at alarms, security, warning, and safety. It seems that seniors are sensitive for ease and improvement of comfort; they do not seem to reject domotics on those grounds. For example: with the introduction and acceptance of the mobile phone, it was after a period of rejection the comfort (ease) which convinced the target group to its daily use in their lives. What is interesting is also the quickly increasing familiarity seniors' show towards technology such as ICT; Internet usage amongst seniors has rapidly increased. All of the focus group members and 85% of the respondents that filled in the survey have an Internet connection.

The investigation into attitudes also suggests that improving the comfort of seniors is a good starting point to familiarize them with domotics. For this reason, the investigation explicitly paid attention to the improvement of the range of domotics applications from the basic appliances such as alarms, to the improvement of residential comfort.

CONCLUSIONS

Despite the developments in ICT over the past decade, domotics has not yet made its breakthrough in the residential sector and is still in the pilot phase even though the possibilities are unlimited. From the technical point of view, a lot has been developed up to now, but a broad introduction has not taken place yet. Evidently, there is stagnation on the route from the developer to the consumer.

This research indicates that social, psychological and cultural, promotional and educational, technological, organizational and financial, and environmental challenges play an important role in determining the attitude and intention to adoption of domotics from the demand side. Science, industries, construction and care sectors should put forward an effort to solve the problems of technology, construction, and architecture. Hence the demand side should be involved in the design process. The transition from a supply driven to a demand driven market, where the user can define his /her requirements, in the construction and architectural field are still seldom occurring.

Domotics has a great potential to ensure that people can age at home, but that it need to be implemented in a more natural and integrated way into the domestic environment. Respectively houses have to be prepared in a better way to accommodate such changes, which at the moment is not the case. Functionalities should be better tuned to the actual needs of the older people and functional requirements such as safety and wellbeing must be revealed.

The domotic homes should be more demand driven, dynamic, and adaptable. In buildings or remodeling of a home, a number of facilities should be introduced as

standard, or the option of installing them later should be kept open by establishing the necessary infrastructures beforehand. Seniors tend to view the adaptability of domotic homes as a huge advantage and sometimes even a necessity.

Becoming older mostly means a decrease in the quality of life due to loss of vitality and its consequences. If this decline in capacity is accepted, then the assimilative refers to a behavioural change: acceptance leads to the loss of the aspired lifestyle. In this case the older citizens are then forced to change according to his/her physical disabilities and limitations and often-unsatisfactory housing situations and Quality of Housing. With an accommodating behavioural reaction to this, the situation can still be kept in hand, through the optimal adjustments and help from domotica to fit the living and care environments according to the tailored needs of the resident. For the architect this accommodative behaviour is the starting point of house adjustments.

Integration and domestication of domotica is the starting point i.e. both in regards to the integration into the routine of the seniors as well as the integration into the construction and architectural concept. It concerns the way in which, the extent to which, and the procedure through which domotics is introduced into the dwelling and by means of that into the life of the senior. Radical changes like moving or implementation of domotica in their housing can infringe upon their set lifestyle. This could result in the rejection of these changes that could be of benefit to them. Domotics should adapt to the dweller and not the other way around; the lifestyle of the inhabitant is therefore expected to be known and recognized. These factors together determine the extent of “empowerment”, through which the senior is equipped and is enabled to live self-reliantly.

However, as long as domotics is immediately associated with sickness and shortcomings, while seniors generally remain healthy for longer (Kolata, 2006), the breakthrough of domotics will not occur. The user-needs analysis displayed an increasing need for comfort in the sense of the absence/reduction of discomfort in their daily activities.

Multi-functionality is one of the solutions, which could influence the chance that a product is adopted by the potential user. According to Goltan (2009), older home owners are less likely than their younger counterparts, to spend money on routine home preservation, to replace or add major equipment or building components or to perform major physical alterations. If the smart product becomes an answer to several of the senior's needs instead of mono-functional care aids, there is a bigger chance that this target group will accept the product. If the senior's needs are identified, new forms of creating home care environment could be initiated. The gap between the need and offering in the residential care provision could then be bridged, both in the case of homes as well as in care institutions. Technology could then bring care from a distance within reach.

In addition, the findings also indicate that the personal attributes of the seniors namely their needs, perceptions, and environment; determine their attitudes towards automation, which can best be described as critical/positive.

It was evident the seniors were not discouraged from domotica, but were critical and not looking forward to living in a techno-lab. However, just filling a building with smart appliances does not make the environment a smart (care) residential facility, but rather creates a gadgety environment where the older citizens will definitely not feel comfortable. The occupant is concerned about living and residing as a whole, and “total enjoyment” (Pennatz, 1979) not about the applications. The dweller does not essentially desire to purchase domotics but spatial and residential comfort and more convenience in daily activities.

Another challenge for the acceptance of domotics is to overcome the stigmatizations attached to it and the fear of becoming dependant. No one wants to rely on technology to take care of him or her; everyone wants to live self sufficiently and autonomously and “stay in charge”. In order to bridge this fear and mental block that hinders the acceptance of domotics its integration and domestication had to be rendered in such a way that it enhances the feeling and experience of independence and not emphasis the reliance aspects. This could be done in ways that give the users control over the domotic appliances and components. Another perspective of looking is from where the empowering function is in the foreground by keeping ‘the human in the loop’ thus empowering people to be in control.

This research reveals that to enable aging-in-place and the acceptance of (care through) domotics we need:

- To familiarize inhabitants with smart technology,
- To domesticate and personalize it,
- As well as to (imperceptibly) apply need-based technology in the (pre-existing) homes, through improvement of residential comfort, efficiency, and sustainability.

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